SONORELLA, A NEW GENUS OF HELICES.

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In a former volume of these *Proeeedings*,[1] the writer in collaboration with Prof. Cockerell established a new genus for certain externally Polygyra-like Helices from Arizona and New Mexico, under the name *Ashmunella*. It was there stated, with some reserve (p. 191), that "*Ashmunella* is a member of the *Belogona euadenia* or Asiatic-American group of dart-bearers, which has lost the dart apparatus and developed apertural characters of the shell similar to those of *Polygyra*." So far as exterior and shell are concerned, *Ashmunella* converges so completely to the *Polygyra* type that the most experienced malacologists in America were deceived, although, if my view be correct, their phylogenetic history has been widely different.

It was therefore with unusual interest that I found that alcoholic specimens of "*Epiphragmophora*" *hachitana* Dall, recently forwarded by the Rev. E. H. Ashmun, confirm the position in classification proposed for *Ashmunella*, or at least they supply a new genus allied to *Ashmunella* in the degeneration of the appendages of the sexual organs, while some other viscera and the shell have the characters of the Belogonous genus *Epiphragmophora*.[2]

SONORELLA n. g.

Gen. Char.—Shell umbilicate, depressed heliciform, similar to *Epiphragmophora*, but neither malleate nor spirally striate; uniform or having a dark shoulder-band usually pale-bordered; the lip more or less expanded. Genitalia without accessory organs on the ♀ side, the spermatheca globose on a very long duct; vagina long; penis small, continued in a much longer epiphallus, the lower portion of which is embraced by the penis retractor; flagel-

[1] *Proc. A. N. S. Phila.* 1899, p. 188. See also 1900, p. 107.

[2] *Conf.* note on a young specimen of *E. hachitana* received from Prof. Cockerell, this volume, p. 109, last paragraph.

lum extremely small. Jaw high, arcuate, with few (five or six) strong ribs grouped in the median part. Teeth with side cusps obsolete on centrals and laterals, otherwise as in *Ashmunella* and many other ground Helices. Salivary glands connected merely by some narrow bands above. Lung with simple pulmonary vein or "rachis," the venation chiefly transverse and on the intestinal side; double the length of kidney. Kidney band-like, three times the length of the pericardium (in the type species).

Type.—*Sonorella hachitana* (Dall).

Distribution.—New Mexico, Arizona (and probably southern California and adjacent portions of Lower California and Mexico).

Affinities.—*Sonorella* is like *Ashmunella* in genitalia except that the spermatheca is normally developed and the epiphallus is more embraced by the penis retractor muscle. It also agrees in the pallial organs except that the lung is shorter. The shell differs widely from that of *Ashmunella*, being like the dart-bearing Californian Helices, from which *Sonorella* differs greatly in genitalia, and to a less degree in the shorter lung, with but slightly developed venation on the cardiac side of the rachis. The new genus therefore stands decidedly nearest to *Ashmunella*, but in some important characters (spermatheca, jaw and shell) it is like *Epiphragmophora*, and thus is a connecting link between the two groups.

Sonorella hachitana.

The specimens examined were collected by Rev. E. H. Ashmun, at Oak Creek, Purtyman's, Arizona.

Genitalia (Pl. XXI, fig 5).—Atrium extremely short. Penis slender and small, continued beyond its apex in an epiphallus of about the same diameter, its lower portion somewhat sinuous and completely enveloped in the lower portion of the penis retractor muscle, which has the usual insertion on the lung floor. Latter portion of the epiphallus free, ending in an extremely short flagellum (fig. 5, *fl.*). The vagina is much longer than the penis; spermatheca ovate and very large, with the duct enlarged for some distance near it; lodged near the heart, and caught in the cephalic loop of the aorta. Duct of the spermatheca very long and slender. Other ♀ organs as in *Helicidæ* generally.

Measurements: length of penis 6 mm.; of epiphallus, portion imbedded in penis 5, free portion 6 mm.; of flagellum .7 mm.

Length of vagina 8 mm.; of spermatheca and its duct 35 mm.; diam. of spermatheca 3.5 mm.

Pallial tract (Pl. XXI, fig. 2).—Lung reticulation almost wholly confined to the intestinal side, where the venation is transverse and branching. Cardiac side almost plain, with only a few faint branches, except toward the anterior extremity. Pulmonary vein simple and direct, with no large branches.

Kidney half the length of the lung, three times that of the pericardium, narrow and band-like. Ureter reflexed, as usual.

Digestive tract.—Jaw (Pl. XXI, fig. 4) similar to that of many *Epiphragmophora* species, short and stout, with five or six strong ribs a little wider than their intervals, and grouped in the median portion, denticulating both margins; the ends of the jaw smooth.

Teeth (Pl. XXI, fig. 3), 37, 1, 37; 13 laterals. Rachidian with the cusp shorter than the basal plate, laterals with it longer, the side cusps obsolete. Marginals with the cusps split, as in *Ashmunella* and *Polygyra*.

Salivary glands (Pl. XXI, fig. 2, *s.g.*) long and irregular, concrescent above the crop by several bands and filaments; separate below. Crop long and tapering. Stomach thick. Folds of the intestine mostly exposed on the lower (inner) face of the left lobe of the liver, part of *G* only immersed.

Free muscles (Pl. XXI, fig. 1).—Left ocular band uniting with the pharyngeal retractor (on its ventral face) at about the posterior third of the length of the latter; all the other main muscles free except at the columellar insertion where they unite. Buccal retractor (*ph.r.*) split into three bands anteriorly, the two lateral branches once forked. Ocular bands giving off a group of pedal retractors, and the tentacular retractors (*r.t.r.*). Tail retractor (*t.r.*) rather long (pulled to the left in the figure). The right ocular retractor passes between the ♂ and ♀ branches of the genitalia.

Comparison with other Genera.

The genitalia of *Sonorella* agree with *Ashmunella* in wanting any trace of dart-sack or mucous glands. The duct of the spermatheca is very long, as in that genus, but it expands into a large ovate spermatheca, as in *Epiphragmophora*, while in *Ashmunella* there is no distal enlargement. The structure of the male organs is like *Ashmunella*, even in the minute vestigial flagellum; but while

Ashmunella has a double insertion of the penis retractor, which is attached to both penis and epiphallus, in *Sonorella* the retractor muscle envelopes the lower portion of the epiphallus, down to the penis. This is a further development of the other structure. In one species of the subgenus *Micrarionta* examined by Mr. Vanatta and myself,[3] the dart-sack is much reduced in size, but the mucous glands remain, the flagellum is long, and the right ocular retractor does not pass between ♂ and ♀ branches of the genitalia. These features are all unlike *hachitana*.

The pallial organs are much alike in *Sonorella*, *Ashmunella*[4] and *Epiphragmophora* (*exarata* and *fidelis* the only species examined); but the venation of the cardiac side is decidedly sparser in the former two, and the kidney is comparatively longer (or perhaps it should be said the lung is shorter) in *Sonorella*, being only about twice the length of the kidney. The proportionate length of pericardium is nearly the same in *Ashmunella* and *Sonorella*. *Polygyra* has a somewhat longer kidney than any of the other genera mentioned.

The teeth are like *Ashmunella* except in the obsolescence of side cusps on the central and lateral teeth. The jaw is decidedly like that of *Epiphragmophora* in both shape and ribbing.

In the free muscles, *Sonorella* agrees with *Ashmunella*, *Epiphragmophora fidelis* and *infumata*, and even with *Helix aspersa*, in having the left ocular and pedal band united with the pharyngeal retractor, *the right ocular and pedal band separate to its insertion.* This arrangement may prove to prevail in the whole of the *Belogona*, though my observations so far cover too few species to generalize upon. In *Polygyra* a widely different arrangement obtains: the right ocular and pedal band being *united with the left to a point anterior to the origin of the pharyngeal retractor.* This arrangement recalls *Limax*, and is widely different from *Sonorella* or *Epiphragmophora*.

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[3] *Epiphragmophora* (*Micrarionta*) *guadalupiana* Dall. These *Proceedings* for 1898, p. 68, Pl. I, fig. 11.

[4] The lung of *Ashmunella thomsoniana porteræ* is shown in fig. 6 of Pl. XXI. Except for the pulmonary vein it appears plain unless viewed by transmitted light, when a sparse venation similar to that of *Sonorella* appears, chiefly on the intestinal side. The kidney is about 3½ times the length of the pericardium, the lung decidedly over double the length of kidney. Measurements are as follows: total length of lung 26, of kidney 12 mm.; and another specimen, lung 24, kidney 11 mm.; the last was measured from the outside through the transparent mantle. The specimens were from the type locality, Beulah, N. M., sent by Prof. T. D. A. Cockerell.

SPECIES OF SONORELLA.

The anatomy is known only in *hachitana;* but from conchological indications, the following species, originally described as "*Helix*" or "*Epiphragmophora,*" probably belong to *Sonorella: magdalenensis* Stearns, *coloradoensis* Stearns,[5] *arizonensis* Dall, *rowelli* Newc., *indioensis* Yates and *lohrii* Gabb, possibly also the true *carpenteri* Newc., though if Binney's description of the genitalia of this species was from a correctly determined specimen, it will belong to *Epiphragmophora.* In the Classified Catalogue published in the *Nautilus*, p. 5 of separate copies, the new genus will probably include numbers 29 or 30 to 35.

Sonorella is probably not much nearer *Epiphragmophora* in shell characters than *Ashmunella* is to *Polygyra;* but in this case the distribution is less restricted and compact, and the prediction of generic position by shell characters may perhaps not have the brilliant fufillment that further material has demonstrated in the case of *Ashmunella.* Still I feel some confidence in the list as given.

This is the third American genus of *Belogona* established since the publication of my *Guide to the Study of Helices*, in 1895, the others being *Ashmunella* Pils. and Ckll. and *Metostracon* Pils. In internal structure the American *Belogona euadenia* are vastly more varied than any known in the Old World.

EXPLANATION OF PLATE XXI.

Fig. 1. *Sonorella hachitana* (Dall). Free muscles, dorsal aspect, the tail retractor brought to the left side. *l.r.*, left labial retractor; *pm.r.*, pharyngeal retractor; *pp.r.*, pedal retractors; *r.o.t.r.*, right ocular tentacle retractor; *r.t.r.*, right tentacular retractor; *t.r.*, tail retractor.

Fig. 2. Pallial region and digestive tract, × 2. G^2, G^4, second and fourth folds of the intestine; *k.*, kidney; *m.*, mantle; *p.*, pneumostome; *s.g.*, salivary glands; *u.*, ureter.

Fig. 3. Teeth.

Fig. 4. Jaw.

Fig. 5. Genitalia. *epi.*, epiphallus; *fl.*, flagellum; *p.*, penis; *p.r.*, retractor muscle of the penis; *sp.*, spermatheca; *sp.d.*, duct of the spermatheca.

Fig. 6. *Ashmunella thomsoniana porterœ* P. and C. Pallial organs.

[5] I have not seen authentic specimens of *coloradoensis* and *arizonensis* and insert them with some reserve.